GB-1965-02

SPECIFICATION

983,980

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Date of Application and filing Complete Specification: February 11, 1964. *No. 5760/64*

(Patent of Addition to No. 964,218 dated May 15, 1962).

Complete Specification Published: February 24, 1965.

Index at Acceptance:—**F2 A** (5B1, 5B4).

Int. Cl.:—F 06 c.

COMPLETE SPECIFICATION

DRAWINGS ATTACHED

Improved Tapered Ball Bearing

I, FRANCIS JOHN LORENZ DORL, a citizen of the United States of America, of 17 Mountain Avenue, Summit, New Jersey, United States of America, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement :—

This invention relates to an improved tapered ball bearing which can withstand radial as well as axial or thrust loads at the same time with little friction.

At the present time tapered roller bearings are generally used, where the bearings are to be subjected to radial and axial loads. In any tapered bearing the conical lines of the inner race and the outer race and the lines of the tapered rollers must meet at one point in the centre of the shaft of the bearing called the apex point.

The tapered roller bearings have inherent defects, which limit their advantageous use. The rollers abut against a retaining flange which is usually an integral part of the inner race. The flange prevents the rollers from slipping out of the bearings. However, when pressure is applied to the tapered roller bearing, the rollers are pressed hard against the flange and serious sliding or bouncing or bubbling friction occurs, due to the rotation of the flange in one direction and the rollers in a counter direction. The friction not only causes wear and tear on the rollers and the retaining flange ; it also tends to deviate the rollers from the apex point.

Another structural defect in a tapered roller bearing is due to the fact that the tapered rollers themselves are rigid rods of comparatively long length. In order for the bearing to function properly, the rollers must be maintained in line with the apex point. If one end of the roller is moved away from its fixed position, there is an angular deflection of the roller from the apex point, which creates wear on the rollers. Attempts have been made to machine the cage, which holds the rollers during assembly, so that it will hold the rollers in line with the apex point during use, but this is not economically feasible.

In British Patent Application No. 18757/62 (Serial No. 964218) there is described a tapered ball bearing including an inner cone having an end thrust flange, an outer bearing cup and at least one other flange providing between the inner cone and the outer bearing cup, two or more tracks, each track being arranged to hold a plurality of balls, the diameter of each of which balls being less than the width of the track in which it rests, and the diameter of the balls in each track increasing the further the track is displaced from the axis of the bearing. This tapered ball bearing functions well, but it is costly to produce due to the precision needed to machine the inner cone with a plurality of flat tracks and flanges.

It is an object of the invention to provide an economical tapered ball bearing capable of withstanding axial and thrust loads.

According to the present invention there is provided a tapered ball bearing comprising an inner cone having an end thrust-flange, a plurality of rows of balls of decreasing diameter resting on the inner cone, loose, movable rings separating said rows of balls and an outer bearing cup.

For a better understanding of the invention and to show how the same may be carried into effect reference will now be made by way of example to the accompanying drawing in which :—

Figure 1 is a cross-sectional view through a tapered ball bearing according to the in-

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vention and,

Figure 2 is a cross-sectional view through a tapered ball bearing, similar to that shown in Figure 1 and having ball cages for easy assembly.

In the embodiment illustrated by Figure 1, the tapered ball bearing is comprised of inner cone 4 with an integral end thrust flange A and a small protrusion 7 which serves to hold the rows of balls in place during assembly. The conical or tapered race surface of the inner cone from corner 11 to point 12 is a straight, continuous surface, when viewed in cross-section. The surface of the outer race or cup 5 of the bearing is also a straight, continuous surface. The inner and outer cones of the present bearings are the same as the inner and outer cones of tapered roller bearings. When the bearing is assembled, the imaginary extended lines of the two said surfaces meet at the apex point 6, which is in the centre of the shaft of the assembled bearing. On the conical surface of the inner cone, rows of balls of diminishing size indicated as 1, 2 and 3 are resting with row 1 resting against end thrust flange A. Between rows 1 and 2 and rows 2 and 3 are loose movable rings B and C, respectively, which might also be called free-floating flanges, since they are loose and are pushed backwards (up the inclined race surface), when subjected to thrust loads allowing the rows of balls to absorb the thrust loads.

The protrusion 7 on the inner cone does not serve any functional purpose once the bearing is assembled and may be omitted altogether if desired. However, the protrusion should be low enough to permit the loose, movable rings B and C to pass over it during assembly.

Each loose, movable ring has preferably a height, which is greater than one-half of the diameter of the smaller balls adjacent to it but less than the diameter of the said balls. In this way, a tangential point of contact is made between the balls and the loose, movable rings. If desired, slight grooves may be provided in the said rings to produce a larger contact surface between the balls and the said rings.

The loose, movable rings rest lightly on the surface of the inner race and they may be slightly rounded or chamfered, where they contact the said surface. To aid the movement of the movable rings on the surface of the inner cone, it is preferred to use a lubricant, where the said rings and the inner cone touch.

Figure 2 illustrates a modification of the embodiment of Figure 1 wherein each row of balls 1, 2 and 3 is held by a cage 9 for easy assembly. The openings in the cages should be suitably, rounded slots (directed to apex) less than the diameter of the balls, so as to permit the inward movements of the balls, so as to permit the inward movements of the balls; otherwise the cage may be made in a conventional manner. Rings B and C are mounted between each row of balls as in the embodiment of Figure 1.

While the tapered ball bearing illustrated in Figures 1 and 2 show three rows of balls, two or more rows of balls of diminishing size may be used depending upon the desired load capacity of the bearing. The balls and the loose, movable rings may be made of any suitable material but are preferably made out of hardened steel.

The tapered ball bearing described above comprises an inner cone having an integral end thrust flange, a plurality of rows of balls of decreasing diameter resting on the inner cone and separated by loose, movable rings or "free-floating flanges" and an outer bearing cup. By having only an end thrust flange on the inner cone of the tapered ball bearing and replacing the other flanges of the bearing described in British Patent Application No. 18757/62 (Serial No. 964218) with loose, movable rings, the inner cones can be more easily produced with the present equipment of the bearing industry and no special machining is needed. Therefore, the bearings of the present invention are simpler and more economical than that described in British Patent Application No. 18757/62 (Serial No. 964218). Furthermore, the present bearing is more suitable for many installations, where the thrust loads are light and the tapered angle is shallow.

The tapered ball bearing of the invention avoids the sliding friction and alignment problems of the tapered roller bearing and is economical to produce.

While the preferred forms of embodiment have been illustrated, various modifications of the invention may be made without departing from the scope of the invention as defined in the appended claims.

WHAT I CLAIM IS:—

1. A tapered ball bearing comprising an inner cone having an end thrust-flange, a plurality of rows of balls of decreasing diameter resting on the inner cone, loose, movable rings separating said rows of balls and an outer bearing cup.

2. A tapered ball bearing comprising an inner cone having an end thrust-flange, three rows of balls of decreasing diameter resting on the inner cone, loose movable rings separating the said rows of balls and an outer bearing cup.

3. A tapered ball bearing comprising an inner cone having an end thrust-flange, a plurality of rows of balls of decreasing diameter resting on the inner cone, loose movable rings separating the said rows of balls, cages to hold the balls and an outer bearing cup.

4. A tapered ball bearing substantially as hereinbefore described with reference to the embodiments illustrated in the accompanying drawing.

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Berwick-upon-Tweed: Printed for Her Majesty's Stationery Office by The Tweeddale Press Ltd.—1965
Published at The Patent Office, 25 Southampton Buildings, London, W.C.2 from which copies may be obtained.